

**Add to section 86-1.01:**

Lighting equipment is included in the following structures:

1. G St over crossing
2. High Speed Rail over crossing

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1. \_\_\_\_\_
2. \_\_\_\_\_

1. \_\_\_\_\_
2. \_\_\_\_\_

Traffic signal work must be performed at the following locations:

1. Fresno St and G St
2. Fresno St and F St

**Add to section 86-1.03:**

Submit a schedule of values within 15 days after Contract approval.

**Add to the 4th paragraph of section 86-1.03:**

- 13. \_\_\_\_\_
- 14. \_\_\_\_\_
- 15. \_\_\_\_\_

**Replace "Reserved" in section 86-1.06B with:**

Traffic Management System (TMS) elements include, but are not limited to ramp metering (RM) system, communication system, traffic monitoring stations, video image vehicle detection system (VIVDS), microwave vehicle detection system (MVDS), loop detection system, changeable message sign (CMS) system, extinguishable message sign (EMS) system, highway advisory radio (HAR) system, closed circuit television (CCTV) camera system, roadway weather information system (RWIS), visibility sensor, and fiber optic system.

Existing TMS elements, including detection systems, shown and located within the project limits must remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown, the Contractor must provide for temporary or portable TMS elements. The Contractor must receive authorization on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer, the Contractor, and the Department's Traffic Operations Electrical representatives must jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements not shown and elements that may not be impacted by the Contractor's activities. The Department's Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor must obtain authorization at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or off line. The Contractor must notify the Engineer at least 72 hours before starting excavation activities.

Traffic monitoring stations and their associated communication systems, which were verified to be operational during the pre-construction operational status check, must remain operational on freeway/highway mainline at all times, except:

1. For a duration of up to 15 days on any continuous segment of the freeway/highway longer than 3 miles
2. For a duration of up to 60 days on any continuous segment of the freeway/highway shorter than 3 miles

If the construction activities require existing detection systems to be nonoperational or off line for a longer time period or the spacing between traffic monitoring stations is more than the specified criteria above, and temporary or portable detection operations are not shown, the Contractor must provide provisions for temporary or portable detection operations. The Contractor must receive authorization on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer must be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, must be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor must install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may authorize temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor must install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized. Fiber optic cable must be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices must be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor must demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment. If the Contractor fails to perform required repairs or replacement work, the Department may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element must be considered nonoperational or off line for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor must provide provisions for replacing existing TMS elements within the project limits, including detection systems, that were not identified on the plans or during the pre-construction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the Department's Traffic Operations Electrical representatives must jointly conduct a post construction operational status check of all existing TMS elements and each element's communication status with the TMC. The Department's Traffic Operations Electrical representatives will certify the TMS elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. TMS elements that cease to be functional between pre and post construction status checks must be repaired at the Contractor's expense.

The Engineer will authorize the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements must be new and of equal or better quality than the existing TMS elements.

If no electrical work exists on the project and no TMS elements are identified within the project limits, the pre-construction operational status check is change order work.

Furnishing and installing temporary or portable TMS elements that are not shown, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, is change order work.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown nor identified during the pre-construction operational status check and were damaged by construction activities is change order work.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

**Add to section 86-2.04A:**

The sign mounting hardware must be installed at the locations shown.

Install non-illuminated street name signs on signal mast arms using a minimum 3/4 by 0.020-inch round edge stainless steel strap and saddle bracket. Wrap the strap at least twice around the mast arm, tighten, and secure with a 3/4-inch stainless strap seal. Level the sign panel and tighten the hardware securely.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

**Add to section 86-2.05A:**

Conduit installed underground must be Type [3](#) and Type [1](#) .as note on plans.

**Add to section 86-2.05B:**

The conduit in a foundation and between a foundation and the nearest pull box must be Type 1 .

**Add to section 86-2.05C:**

If a standard coupling cannot be used for joining Type 1 conduit, use a UL-listed threaded union coupling under section 86-2.05C, a concrete-tight split coupling, or a concrete-tight set screw coupling.

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets must be sealed with an authorized type of sealing compound.

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The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

**Delete items 2–5 in the list in the 2nd paragraph of section 86-2.06A(2).**

**Add to section 86-2.06A(2):**

**Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:**

**86-2.06B(1) General**

**86-2.06B(1)(a) Summary**

This work includes installing non-traffic-rated pull boxes.

**86-2.06B(1)(b) Submittals**

Before shipping pull boxes to the jobsite, submit a list of materials, Contract number, pull box manufacturer, manufacturer's instructions for pull box installation, and your contact information to METS.

Submit reports for pull box from an NRTL-accredited lab.

**86-2.06B(1)(c) Quality Control and Assurance**

**86-2.06B(1)(c)(i) General**

Pull boxes may be tested by the Department. Deliver pull boxes and covers to METS and allow 30 days for testing. When testing is complete, you will be notified. You must pick up the boxes and covers from the test site and deliver it to the job site.

Any failure of the pull box or the cover that renders the unit noncompliant with these specifications will be a cause for rejection. If the unit is rejected, you must allow 30 days for retesting. Retesting period starts when the replacement pull box is delivered to the test site. You must pay for all retesting costs. Delays resulting from the submittal of noncompliant materials does not relieve you from executing the Contract within the allotted time.

If the pull box submitted for testing does not comply with the specifications, remove the unit from the test site within 5 business days after notification that it is rejected. If the unit is not removed within that period, it may be shipped to you at your expense.

You must pay for all shipping, handling, and transportation costs related to the testing and retesting.

**86-2.06B(1)(c)(ii) Functional Testing**

The pull box and cover must be tested under ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity."

**86-2.06B(1)(c)(iii) Warranty**

Provide a 2-year manufacturer replacement warranty for pull box and cover from the date of installation of the pull box and cover. All warranty documentation must be submitted before installation.

Replacement parts must be provided within 5 business days after receipt of failed pull box, cover, or both at no cost to the Department and must be delivered to the Department's Maintenance Electrical Shop at [2101 G Street, Building A-TOC Fresno Ca 93706](#).

**86-2.06B(2) Materials**

The pull box and cover must comply with ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity," for Tier 22 load rating and must be gray or brown in color.

Each pull box cover must have an electronic marker cast inside.

Extension for the pull box must be of the same material as the pull box and attached to the pull box to maintain the minimum combined depths as shown.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive bolt design.

The captive bolt design must be capable of withstanding a torque range of 55 to 60 ft-lb and a minimum pull out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test to the minimum pull out strength.

Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts under section 75-1-.05.

Manufacturer's instructions must provide guidance on:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below Tier 22 load rating
2. Where side entries cannot be made
3. Acceptable method to be used to create the entry

Tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

### **86-2.06B(3) Construction**

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

Bury pull box in soil 6 to 8 inches below grade. Cover the pull box with a plastic sheet before burying it.

Plastic sheets must be 20 mil thick and made of HDPE or PVC virgin compounds.

If only the cover is to be replaced, anchor the cover to the pull box.



**Add to section 86-2.08A:**

Wrap conductors around the projecting end of conduit in pull boxes as shown. Secure conductors and cables to the projecting end of the conduit in pull boxes.

**Replace the 1st sentence of the 1st paragraph of section 86-2.08E with:**

Signal interconnect cable must be the 3-pair type with stranded tinned copper no. 20 conductors.

**Add to section 86-2.11A:**

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers must be the cable-in/cable-out type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

**Replace item 9 in the list in the 5th paragraph of section 86-2.11A with:**

**Replace 7th and 8th paragraphs of section 86-2.11A with:**

**Replace section 86-2.18 with:**

**86-2.18 NUMBERING ELECTRICAL EQUIPMENT**

The placement of numbers on electrical equipment will be done by others.

**Replace 1st paragraph of section 86-2.18 with:**

**Delete 2nd sentence of 3rd paragraph of section 86-2.18.**

**Replace the 2nd paragraph of section 86-3.01B with:**

Construct each controller cabinet foundation as shown for Model 33L cabinet, including furnishing and installing anchor bolts, install the controller cabinet on the foundation, and make field wiring connections to the terminal blocks in the controller cabinet.

**Add to section 86-3.04:**

Cabinet must be Model [332L](#) and consist of a housing (B), a mounting cage 1, and the following listed equipment. The equipment must comply with chapter 6 of TEES [and City of Fresno Public Work Department Standard Specifications](#).

1. Service panel no. 1
2. Power distribution assembly no. 3
3. Input file (I file)
4. C1 harness
5. Controller and equipment shelves
6. Dual fan assembly with thermostatic control
7. Mechanical armature-type relays
8. Input panel

Before shipping to the job site, submit each [332L](#) cabinet to METS for acceptance testing.

Notify the Engineer when each [332L](#) cabinet is ready for functional testing. Functional testing will be conducted by the [City of Fresno Public Work Department](#).

Each power distribution assembly must include the following equipment:

1. Two duplex NEMA 5-15R controller receptacle (rear mount)
2. One 30 A, 1-pole, 120 V(ac) main circuit breaker
3. Three 15 A, 1-pole, 120 V(ac) circuit breaker
4. One duplex GFCI NEMA 15 A, receptacle (front mount)

Furnish 3 shelves as shown. Each shelf must be attached to the tops of 2 supporting angles with 4 screws. Supporting angles must extend from the front to the back rails. The front of the shelf must abut the front member of the mounting cage. Arrange shelves as shown. The angles must be designed to

support a minimum of 50 pounds each. The horizontal side of each angle must be a minimum of 3 inches. The angles must be vertically adjustable.

Furnish 3 terminal blocks as shown. Terminal blocks must comply with Chapter 6 of TEES, except the screw size must be 8-32.

Furnish a maintenance manual or a combined maintenance and operation manual for all controller units, auxiliary equipment, vehicle detector sensor units, control units, and amplifiers. Submit manual when the controllers are delivered for testing or, if ordered by the Engineer, before purchasing. The manual must include the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Troubleshooting procedure (diagnostic routine)
6. Block circuit diagram
7. Geographical layout of components
8. Schematic diagrams
9. List of replaceable component parts with stock numbers

**Replace section 86-4.01D(1)(c)(ii) with:**

**86-4.01D(1)(c)(ii) Warranty**

The manufacturer must provide a written warranty against defects in materials and workmanship for LED signal modules for a minimum period of 48 months after installation of LED signal modules. Replacement LED signal modules must be provided within 15 days after receipt of failed LED modules at your expense. The Department pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED signal modules must be delivered to [City of Fresno Public Work Department](#) Maintenance Electrical Shop at [2101 G Street, Building A-TOC Fresno Ca 93706](#).

**Add to section 86-4.01D(2)(a):**

LED signal module must be manufactured for 12-inch circular, arrow, sections.

**Replace section 86-4.03I(1)(c)(ii) with:**

**86-4.03I(1)(c)(ii) Warranty**

The manufacturer must provide a written warranty against defects in materials and workmanship for LED PSF modules for a minimum period of 48 months after installation of LED PSF modules. Replacement LED PSF modules must be provided within 15 days after receipt of failed LED PSF modules at your expense. The Department pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED PSF modules must be delivered to [City of Fresno Public Work Department](#) Maintenance Electrical Shop at [2101 G Street, Building A-TOC Fresno Ca 93706](#).

**Add to section 86-4.03I(2):**

**Add to section 86-5.01A(1):**

Loop wire must be Type 2.

Loop detector lead-in cable must be Type B

Slots must be filled with hot-melt rubberized asphalt sealant.

You may use a Type E loop where a Type A or a Type B loop is shown.

For Type E detector loops, sides of the slot must be vertical and the minimum radius of the slot entering and leaving the circular part of the loop must be 1-1/2 inches. Slot width must be a maximum of 5/8 inch. Loop wire for circular loops must be Type 2. Slots of circular loops must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

The depth of the loop sealant above the top of the uppermost loop wire in the sawed slots must be 2 inches, minimum.

**Replace "Reserved" in section 86-5.01D with:**

**86-5.01D(1) General**

Each traffic signal must have an emergency vehicle detector system that must comply with the details shown and the special provisions.

Each emergency vehicle detector system must consist of an optical emitter assembly or assemblies located on the appropriate vehicle and an optical detector/discriminator assembly or assemblies located at the traffic signal.

Emitter assemblies are not required for this project except units for testing purposes to demonstrate that the systems perform as specified. Tests must be conducted in the presence of the Engineer as described below under "System Operation" during the signal test period. The Engineer must be provided a minimum of 2 working days notice prior to performing the tests.

Each system must allow detection of 2 classes of authorized vehicles. Class I (mass transit) vehicles must be detected at ranges of up to 1,000 feet from the optical detector. Class II (emergency) vehicles must be detected at ranges up to 1,800 feet from the optical detector.

Class I signals (those emitted by Class I vehicles) must be distinguished from Class II signals (those emitted by Class II vehicles) on the basis of the modulation frequency of the light from the respective emitter. The modulation frequency for Class I signal emitters must be  $9.639 \text{ Hz} \pm 0.110 \text{ Hz}$ . The modulation frequency for Class II signal emitters must be  $14.035 \text{ Hz} \pm 0.250 \text{ Hz}$ .

A system must establish a priority of Class II vehicle signals over Class I vehicle signals and must comply with the requirements in section 25352 of the California Vehicle Code.

**86-5.01D(2) Emitter Assembly**

Each emitter assembly, provided for testing purposes, must consist of an emitter unit, an emitter control unit, and connecting cables.

**86-5.01D(2)(a) General**

Each emitter assembly, including lamp, must operate over an ambient temperature range of -34 to +60 degrees C at both modulation frequencies and operate continuously at the higher frequency for a minimum of 3,000 hours at 25degrees C ambient before failure of the lamp or other components.

Each emitter unit must be controlled by a single, maintained-contact switch on the respective emitter control unit. The switch must be located to be readily accessible to the vehicle driver. The control unit must contain a pilot light to indicate that the emitter power circuit is energized and must generate only 1 modulating code, either that for Class I vehicles or that for Class II vehicles.

**86-5.01D(2)(b) Functional**

Each emitter unit must transmit optical energy in 1 direction only.

The signal from each Class I signal emitter unit must be detectable at a distance of 1,000 feet when used with a standard optical detection/discriminator assembly and filter to eliminate visible light. Visible light must be considered eliminated when the output of the emitter unit with the filter is less than an average of 0.0003 candela per energy pulse in the wavelength range of 380 nm to 750 nm when measured at a distance of 10 feet. Submit a certificate of compliance for each Class I emitter unit.

The signal from each Class II signal emitter unit must be detectable at a distance of 1,800 feet when used with a standard optical detection/discriminator assembly.

The standard optical detection/discriminator assembly to be used in making the range tests must be available from the manufacturer of the system. A certified performance report must be furnished with each assembly.

**86-5.01D(2)(c) Electrical**

Each emitter assembly must provide full light output with input voltages of between 12.5 V (dc) and 17.5 V (dc). An emitter assembly must not be damaged by input voltages up to 7.5 V (dc) above supply voltage. The emitter assembly must not generate voltage transients, on the input supply, that exceed the supply voltage by more than 4 volts.

Each emitter assembly must consume not more than 100 W at 17.5 V (dc) and must have a power input circuit breaker rated at 10 A to 12 A, 12 V (dc).

The design and circuitry of each emitter must allow its use on vehicles with either negative or positive ground without disassembling or rewiring of the unit.

#### **86-5.01D(2)(d) Mechanical**

Each emitter unit must be housed in a weatherproof corrosion-resistant housing. The housing must be provided with facilities to allow mounting on various types of vehicles and must have provision for aligning the emitter unit properly and for locking the emitter unit into this alignment.

Each emitter control unit must be provided with hardware to allow the unit to be mounted in or on an emergency vehicle or mass transit vehicle. Where required for certain emergency vehicles, the emitter control unit and exposed controls must be weatherproof.

#### **86-5.01D(3) Optical Detection/Discriminator Assembly**

##### **86-5.01D(3)(a) General**

Each optical detection/discriminator assembly must consist of 1 or more optical detectors, connecting cable and a discriminator module.

Each assembly, when used with standard emitters, must have a range of at least 1,000 feet for Class I signals and 1,800 feet for Class II signals. Standard emitters for both classes of signals must be available from the manufacturer of the system. Range measurements must be taken with all range adjustments on the discriminator module set to "maximum".

##### **86-5.01D(3)(b) Optical Detector**

Each optical detector must be a waterproof unit capable of receiving optical energy from 2 separately aimable directions. The horizontal angle between the 2 directions must be variable from 180 degrees to 5 degrees.

The reception angle for each photocell assembly must be a maximum of 8 degrees in all directions about the aiming axis of the assembly. Measurements of reception angle will be taken at a range of 1,000 feet for a Type I emitter and at a range of 1,800 feet for a Type II emitter.

Internal circuitry must be solid state and electrical power must be provided by the associated discriminator module.

Each optical detector must be contained in a housing, which must include 2 rotatable photocell assemblies, an electronic assembly and a base. The base must have an opening to allow mounting on a mast arm or a vertical pipe nipple, or suspension from a span wire. The mounting opening must have female threads for 3/4 inch conduit. A cable entrance must be provided which must have male threads and gasketing to allow a waterproof cable connection. Each detector must have weight of less than 2.5 pounds and must present a maximum wind load area of 36 square inches. The housing must be provided with weep holes to allow drainage of condensed moisture.

Each optical detector must be installed, wired and aimed as specified by the manufacturer.

##### **86-5.01D(3)(c) Cable**

Optical detector cable (EV-C) must comply with the requirements of IPCEA-S-61-402/NEMA WC 5, section 7.4, 600-V (ac) control cable, 75 degrees C, Type B, and the following:

1. The cable must contain 3 conductors, each of which must be No. 20 (7 x 28) stranded, tinned copper with low-density polyethylene insulation. Minimum average insulation thickness must be 25 mils. Insulation of individual conductors must be color coded: 1-yellow, 1-blue, 1-orange.
2. The shield must be either tinned copper braid or aluminized polyester film with a nominal 20 percent overlap. Where film is used, a No. 20 (7 x 28) stranded, tinned, bare drain wire must be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
3. The jacket must be black polyvinyl chloride with minimum ratings of 600 V (ac) and 80 degrees C and a minimum average thickness of 43 mils. The jacket must be marked as required by IPCEA/NEMA.
4. The finished outside diameter of the cable must not exceed 0.35-inch.



5. The capacitance, as measured between any conductor and the other conductors and the shield, must not exceed 48 pf per foot at 1000 Hz.
6. The cable run between each detector and the controller cabinet must be continuous without splices or must be spliced only as directed by the detector manufacturer.

#### **86-5.01D(3)(d) Discriminator Module**

Each discriminator module must be designed to be compatible and usable with a Model 170E controller unit and to be mounted in the input file of a Model 332L or Model 336L controller cabinet, and must comply with the requirements of chapter I of the State of California, Department of Transportation, "Traffic Signal Control Equipment Specifications."

Each discriminator module must be capable of operating 2 channels, each of which must provide an independent output for each separate input.

Each discriminator module, when used with its associated detectors, must perform the following:

1. Receive Class I signals at a range of up to 1,000 feet and Class II signals at a range of up to 1,800 feet.
2. Decode the signals, on the basis of frequency, at  $9.639 \text{ Hz} \pm 0.119 \text{ Hz}$  for Class I signals and  $14.035 \text{ Hz} \pm 0.255 \text{ Hz}$  for Class II signals.
3. Establish the validity of received signals on the basis of frequency and length of time received. A signal must be considered valid only when received for more than 0.50-second. No combination of Class I signals must be recognized as a Class II signal regardless of the number of signals being received, up to a maximum of 10 signals. Once a valid signal has been recognized, the effect must be held by the module in the event of temporary loss of the signal for a period adjustable from 4.5 seconds to 11 seconds in at least 2 steps at  $5 \text{ seconds} \pm 0.5 \text{ second}$  and  $10 \text{ seconds} \pm 0.5 \text{ second}$ .
4. Provide an output for each channel that will result in a "low" or grounded condition of the appropriate input of a Model 170E controller unit. For Class I signals the output must be a  $6.25 \text{ Hz} \pm 0.1 \text{ percent}$ , rectangular waveform with a 50 percent duty cycle. For Class II signals the output must be steady.

Each discriminator module must receive electric power from the controller cabinet at either 24 V (dc) or 120 V (ac).

Each channel together with the channel's associated detectors must draw not more than 100 mA at 24 V (dc) or more than 100 mA at 120 V (ac). Electric power, 1 detector input for each channel and 1 output for each channel must terminate at the printed circuit board edge connector pins shown in the following table:

**Board Edge Connector Pin Assignment**

A	DC ground		
B	+24 V (dc)	P	(NC)
C	(NC)		
D	Detector input, Channel A	R	(NC)
E	+24V (dc) to detectors	S	(NC)
F	Channel A output (C)	T	(NC)
		U	(NC)
H	Channel A output (E)	V	(NC)
J	Detector input, Channel B	W	Channel B output (C)
K	DC ground to detectors	X	Channel B output (E)
L	Chassis ground	Y	(NC)
M	AC-	Z	(NC)
N	AC+		

(C) Collector, slotted for keying

(E) Emitter, slotted for keying

(NC) Not connected, cannot be used by manufacturer for any purpose.

Two auxiliary inputs for each channel must enter each module through the front panel connector. Pin assignment for the connector must be as follows:

1. Auxiliary detector 1 input, Channel A
2. Auxiliary detector 2 input, Channel A
3. Auxiliary detector 1 input, Channel B
4. Auxiliary detector 2 input, Channel B

Each channel output must be an optically isolated NPN open collector transistor capable of sinking 50 mA at 30 V (ac) and must be compatible with the Model 170E controller unit inputs.

Each discriminator module must be provided with means of preventing transients received by the detector from affecting the Model 170E controller assembly.

Each discriminator module must have a single connector board and must occupy 1 slot width of the input file. The front panel of each module must have a handle to facilitate withdrawal and the following controls and indicators for each channel:

1. Three separate range adjustments each for both Class I and Class II signals.
2. A 3-position, center-off, momentary contact switch, 1 position (down) labeled for test operation of Class I signals, and 1 position (up) labeled for test operation of Class II signals.
3. A "signal" indication and a "call" indication each for Class I and for Class II signals. The "signal" indication denotes that a signal above the threshold level has been received. A "call" indication denotes that a steady, validly coded signal has been received. These 2 indications may be accomplished with a single indication lamp; "signal" being denoted by a flashing indication and "call" with a steady indication.

In addition, the front panel must be provided with a single circular, bayonet-captured, multi-pin connector for 2 auxiliary detector inputs for each channel. Connector must be a mechanical configuration complying with the requirements in Military Specification MIL-C-26482 with 10-4 insert arrangement, such as Burndy Trim Trio Bantamate Series, consisting of the following:

1. Wall mounting receptacle, G0B10-4PNE with SM20M-1S6 gold plated pins.
2. Plug, G6L10-4SNE with SC20M-1S6 gold plated sockets, cable clamp and strain relief that must provide for a right angle turn within 2-1/2 inches maximum from the front panel surface of the discriminator module.

### **86-5.01D(3)(e) Cabinet Wiring**

The Model 332L cabinet has provisions for connections between the optical detectors, the discriminator module and the Model 170E controller unit.

Wiring for a Model 332L cabinet must comply with the following:

1. Slots 12 and 13 of input file "J" have each been wired to accept a 2-channel module.
2. Field wiring for the primary detectors, except 24-V (dc) power, must terminate on either terminal board TB-9 in the controller cabinet or on the rear of input file "J," depending on cabinet configuration. Where TB-9 is used, position assignments must be as shown in the following table:

Position	Assignment
4	Channel A detector input, 1st module (Slot J-12)
5	Channel B detector input, 1st module (Slot J-12)
7	Channel A detector input, 2nd module (Slot J-13)
8	Channel B detector input, 2nd module (Slot J-13)

The 24-V (dc) cabinet power will be available at Position 1 of terminal board TB-1 in the controller cabinet.

Field wiring for the auxiliary detectors must terminate on terminal board TB-O in the controller cabinet. Position assignments are as shown in the following table:

For module 1 (J-12)		For module 2 (J-13)	
Position	Assignment	Position	Assignment
1	+24V (dc) from (J-12E)	7	+24V (dc) from (J-13E)
2	Detector ground From (J-12K)	8	Detector ground from (J-13K)
3	Channel A auxiliary detector input 1	9	Channel A auxiliary detector input 1
4	Channel A auxiliary detector input 2	10	Channel A auxiliary detector input 2
5	Channel B auxiliary detector input 1	11	Channel B auxiliary detector input 1
6	Channel B auxiliary detector input 2	12	Channel B auxiliary detector input 2

#### **86-5.01D(4) System Operation**

The Contractor must demonstrate that the components of each system are compatible and will perform satisfactorily as a system. Satisfactory performance must be determined using the following test procedure during the functional test period:

1. Each system to be used for testing must consist of an optical emitter assembly, an optical detector, an optical detector cable and a discriminator module.
2. The discriminator modules must be installed in the proper input file slot of the Model 170E controller assembly.
3. Two tests must be conducted; 1 using a Class I signal emitter and a distance of 1,000 feet between the emitter and the detector, the other using a Class II signal emitter and a distance of 1,800 feet between the emitter and the detector. Range adjustments on the module must be set to "Maximum" for each test.
4. Each test must be conducted for a period of 1 hour, during which the emitter must be operated for 30 cycles, each consisting of a 1 minute "on" interval and a 1 minute "off" interval. During the total test period the emitter signal must cause the proper response from the Model 170E controller unit during each "on" interval and there must be no improper operation of either the Model 170E controller unit or the monitor during each "off" interval.

**Add to section 86-6.01:**

Ballasts must be the lag or lead regulator, type.

**City Street Lighting**

City street lighting shall conform to the City of Fresno, Public Work Department Standard, except that payment for street lights, conduit and conductors, and pull boxes shall be included in the bid items for Lighting (City Street Light)

**General**

This work shall include the furnishing of all labor, materials, tools, and equipment to construct and complete in an efficient and workmanlike manner the installation of the street lighting and electrical system in accordance with the approved plans, these specifications, the City of Fresno Public Work Department Standard Specifications, City of Fresno Public Work Department Standard Plans Drawings and Details, and the State Specifications and State Standard Plans.

Electrical equipment shall conform to the requirements of the National Electrical Manufacturers Association and material and work shall conform to the requirements of the National Electrical Code, the Electrical Safety Orders of the Division of Industrial Safety, Department of Industrial Relations of the State of California; Rules for Overhead Line Construction G.O 95, State of California, Public Utilities Commission, the Standards of the American Society for Testing Materials and the American National Standards Institute.

**Add to section 86-6.05:**

Install a no. 7 pull box adjacent to soffit luminaires only at the locations shown.

**Add to section 86-8.01:**

Payment for [safety](#) lighting at intersections in connection with signals is included in the payment for signal and lighting.

Payment for other roadway lighting on the project is included in the payment for [City Street Lighting and Sign Illumination](#).

For each item shown in the following table, the Department deducts the corresponding amount shown:

Source Inspection Expense Deductions		
Item	Distance <sup>a</sup>	Deduction
Service equipment enclosures	> 300	\$2,000

<sup>a</sup>Distance is air-line miles from both Sacramento and Los Angeles to the inspection source.

**Replace section 15-2.03A(2)(b) with:**

**15-2.03A(2)(b) Department Salvage Location**

A minimum of 2 business days before hauling salvaged material to the Department salvage storage location, notify:

1. Engineer
2. Recycle coordinator at telephone number [\(559\) 621-1312](#)

For [electrical equipment](#), the Department salvage storage location is:

[City of Fresno Public Work Department Maintenance Yard, 2101 G Street, Building A TOC Fresno Ca 93706](#)

**ELECTRICAL SYSTEMS - LEGEND, NOTES AND ABBREVIATIONS**

ES-1A	Electrical Systems (Legend, Notes and Abbreviations)
ES-1B	Electrical Systems (Legend, Notes and Abbreviations)
ES-1C	Electrical Systems (Legend, Notes and Abbreviations)
<b>ELECTRICAL SYSTEMS - SERVICE EQUIPMENT AND WIRING DIAGRAMS</b>	
ES-2D	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram, Type III - A Series)
<b>ELECTRICAL SYSTEMS - SIGNAL HEADS, SIGNAL FACES AND MOUNTINGS</b>	
ES-4A	Electrical Systems (Signal Heads and Mountings)
ES-4B	Electrical Systems (Pedestrian Signal and Ramp Metering)
ES-4C	Electrical Systems (Vehicular Signal Heads and Mountings)
ES-4D	Electrical Systems (Signal Mounting)
ES-4E	Electrical Systems (Signal Faces and Emergency Vehicle Detector Mountings)
<b>ELECTRICAL SYSTEMS - DETECTORS</b>	
ES-5A	Electrical Systems (Detectors)
ES-5B	Electrical Systems (Detectors)
ES-5C	Electrical Systems (Detector, Pedestrian Push Button and Signs)
ES-5D	Electrical Systems (Curb Termination and Handhole)

	<b>ELECTRICAL SYSTEMS - SIGNAL AND LIGHTING STANDARD, TYPE TS, AND PEDESTRIAN PUSH BUTTON POST</b>
ES-7A	Electrical Systems (Signal and Lighting Standard, Type TS, and Pedestrian Push Button Post)
ES-7B	Electrical Systems (Signal and Lighting Standard - Type 1 and Equipment Numbering)
	<b>ELECTRICAL SYSTEMS - SIGNAL AND LIGHTING STANDARD DETAILS</b>
ES-7M	Electrical Systems (Signal and Lighting Standard - Detail No. 1)
ES-7N	Electrical Systems (Signal and Lighting Standard - Detail No. 2)
ES-7O	Electrical Systems (Signal and Lighting Standard - Detail No. 3)
	<b>ELECTRICAL SYSTEMS - PULL BOX</b>
ES-8	Electrical Systems (Pull Box)
	<b>ELECTRICAL SYSTEMS - STRUCTURE INSTALLATIONS</b>
ES-9A	Electrical Systems (Structure Pull Box Installations)
ES-9B	Electrical Systems (Conduit Riser and Expansion Fitting, Structure Installations)
ES-9C	Electrical Systems (Structure Pull Box)
ES-9D	Electrical Systems (Structure Pull Box Installations)
ES-9E	Electrical Systems (Flush Soffit, Pendant soffit and Wall Luminaire, Structure Installations)
ES-9F	Electrical Systems (Flush Soffit Luminaire Details)
	<b>ELECTRICAL SYSTEMS - ISOFOOTCANDLE DIAGRAMS AND FOUNDATION DETAILS</b>
ES-10	Electrical Systems (Isofootcandle Diagrams)
ES-11	Electrical Systems (Foundation Installations)
	<b>ELECTRICAL SYSTEMS - SPLICING, FUSE RATING, KINKING AND BANDING DETAILS</b>
ES-13A	Electrical Systems (Splicing Details)
ES-13B	Electrical Systems (Fuse Rating, Kinking and Banding Detail)
	<del><b>ELECTRICAL SYSTEMS - EXTINGUISHABLE MESSAGE SIGN</b></del>
	<b>ELECTRICAL SYSTEMS - SIGN ILLUMINATION EQUIPMENT AND CONTROLS</b>
ES-15A	Electrical Systems (Sign Illumination Equipment)
ES-15B	Electrical Systems (36" Fluorescent Sign Illumination Equipment)
ES-15C	Electrical Systems (Sign Illumination Equipment)
ES-15D	Electrical Systems (Lighting and Sign Illumination Control)

**CITY OF FRESNO PUBLIC WORK DEPARTMENT**  
**STANDARD PLANS DRAWING**  
**(NOVEMBER 2011)**

<u>E-1</u>	<u>STREETLIGHT - MAJOR STREET (WITH BASE PULL BOXES &amp; PVC CONDUITS)</u>
<u>E-3</u>	<u>STREETLIGHTS /TRAFFIC SIGNALS (CONCRETE PULL BOXES)</u>
<u>E-5</u>	<u>STREETLIGHT - (CONNECTON DIAGRAM)</u>
<u>E-6</u>	<u>STREETLIGHT - (LAYOUT)</u>
<u>E-7</u>	<u>STREETLIGHT - PLACEMENT (DIVIDED ARTERIAL STREETS)</u>
<u>E-7</u>	<u>STREETLIGHT - PLACEMENT (COLLECTOR STREETS)</u>
<u>E-7</u>	<u>STREETLIGHT - PLACEMENT (LOCAL STREETS)</u>
<u>E-7</u>	<u>STREETLIGHT - PLACEMENT (EXPRESSWAY)</u>
<u>E-13</u>	<u>SIGNAL LIGHTS (PVC ENCASE LOOP DETECTORS)</u>
<u>E-14</u>	<u>SIGNAL LIGHTS (LOOP DETECTOR PLACEMENT)</u>
<u>E-15</u>	<u>SIGNAL LIGHTS (WIRING NEW INSTALLATIONS 26-100 CABINETS)</u>
<u>E-17</u>	<u>SIGNAL LIGHTS (SERVICE FOUNDATION DETAIL)</u>
<u>E-18</u>	<u>STREETLIGHT (WIRING)</u>
<u>E-19</u>	<u>VEHICLE SIGNAL (TERMINAL LOCATION)</u>
<u>E-20</u>	<u>PEDESTRIAN SIGNAL &amp; PBB (TERMINAL LOCATION)</u>
<u>E-23</u>	<u>SIGNAL LIGHTS (COORDINATION CABLE TERMINATION)</u>
<u>E-24</u>	<u>SIGNAL LIGHTS (EQUIPMENT PLACEMENT GUIDELINE)</u>
<u>E-25</u>	<u>STREETLIGHT / SAFETY LIGHT (POLE NUMBERING)</u>
<u>E-27</u>	<u>SIGNAL LIGHTS (FOUNDATION WIRE - WAY DETAIL)</u>
<u>E-28</u>	<u>STREETLIGHT POINT OF SERVICE (CONCRETE PULL BOX)</u>
<u>E-29</u>	<u>DOWNTOWN SIGNAL &amp; STREETLIGHT POLES (DECORATIVE POLE BOUNDARY)</u>
<u>E-30</u>	<u>DOWNTOWN STREETLIGHT (DECORATIVE POLE DETAIL)</u>
<u>E-31</u>	<u>DOWNTOWN SIGNAL POLES (DECORATIVE POLE DETAILS-TYPE 1-A, 16, 17B)</u>
<u>E-32</u>	<u>DOWNTOWN SIGNAL POLES (DECORATIVE POLE DETAILS-TYPE 19, 24)</u>
<u>E-33</u>	<u>DOWNTOWN SIGNAL POLES (DECORATIVE POLE DETAILS-TYPE 26, 29)</u>
<u>E-34A</u>	<u>EMERGENCY VEHICLE PREEMPTION OPTICAL CONNECTION (727 DETECTOR AND TERMINAL BLOCK CONNECTIONS)</u>
<u>E-34B</u>	<u>332L CABINET/2070L DETECTION (C11S CABLE CONNECTIONS AND MASTER/SIGNAL CB)</u>
<u>ITS-4</u>	<u>ITS CONDUIT TRENCH (DETAIL NO. 1)</u>
<u>ITS-5</u>	<u>ITS CONDUIT TRENCH (DETAIL NO. 2)</u>

<u>ITS-6</u>	<u>ITS CONDUIT TRENCH (LAYOUT NO. 1)</u>
<u>ITS-7</u>	<u>ITS CONDUIT TRENCH (LAYOUT NO. 2)</u>
<u>ITS-8</u>	<u>ITS CONDUIT TRENCH (LAYOUT NO. 3)</u>
<u>ITS-9</u>	<u>ITS CONDUIT TRENCH (LAYOUT NO. 4)</u>
<u>ITS-10</u>	<u>ITS CONDUIT TRENCH (LAYOUT NO. 10)</u>
<u>ITS-13</u>	<u>ITS 4'x7' VAULT (DETAIL NO. 1)</u>
<u>ITS-14</u>	<u>ITS 4'x7' VAULT (DETAIL NO. 2)</u>
<u>ITS-18</u>	<u>IP CAMERA</u>
<u>ITS-20</u>	<u>COMMUNICATION CABINET DETAILS</u>
<u>ITS-20A</u>	<u>MODEL 336 COMMUNICATION CABINET DETAILS</u>
<u>ITS-21</u>	<u>COMMUNICATION CABINET WIRING DIAGRAM</u>
<u>ITS-21A</u>	<u>MODEL 336 COMMUNICATION CABINET WIRING DIAGRAM</u>
<u>ITS-21B</u>	<u>MODEL 336 COMMUNICATION CABINET EQUIPMENT ASSEMBLIES</u>